ANSWERS

Atomic Energy Levels

1. What is the energy of the emitted photon when a hydrogen atom changes from an energy state of n = 5 to n = 4?
   (1) 13.06 eV (3) 0.54 eV
   (2) 1.39 eV (4) 0.31 eV

2. A hydrogen atom undergoes a transition from the n = 4 state to the n = 1 state. The energy of the single photon emitted during the transition is approximately
   (1) 13.6 eV (3) 2.55 eV
   (2) 12.75 eV (4) 0.85 eV

3. Which photon energy could be absorbed by a hydrogen atom that is in the n = 2 state?
   (1) 1.51 eV (3) 2.1 eV
   (2) 1.89 eV (4) 2.4 eV

4. If a hydrogen atom absorbs 1.9 eV of energy, it could be excited from energy level
   (1) n = 1 to n = 2 (3) n = 2 to n = 3
   (2) n = 1 to n = 3 (4) n = 2 to n = 4

5. A photon having an energy of 15.5 electron volts is incident upon a hydrogen atom in the ground state. If the photon is absorbed by the atom, it will
   (1) ionize the atom (3) excite the atom to n = 3
   (2) excite the atom to n = 2 (4) excite the atom to n = 4

6. A photon emitted from an excited hydrogen atom has an energy of 3.02 electronvolts. Which electron energy-level transition would produce this photon?
   (1) n = 1 to n = 6 (3) n = 6 to n = 1
   (2) n = 2 to n = 6 (4) n = 6 to n = 2

7. A hydrogen atom could have an electron energy-level transition from n = 2 to n = 3 by absorbing a photon having an energy of
   (1) 1.51 eV (3) 4.91 eV
   (2) 1.89 eV (4) 10.20 eV

8. An excited hydrogen atom returns to its ground state. A possible energy change for the atom is a
   (1) loss of 10.20 eV (3) loss of 3.40 eV
   (2) gain of 10.20 eV (4) gain of 3.40 eV

9. A hydrogen atom emits blue light when it changes from the n = 4 energy level to the n = 2 energy level. Which color of light would the atom emit when it changes from the n = 5 level to the n = 2 level?
   (1) red (3) green
   (2) yellow (4) violet

10. As excited an excited electrons in hydrogen atoms return to the ground state, they emit
    (1) electrons (3) photons
    (2) protons (4) neutrons

11. Several hydrogen atoms are supplied with sufficient energy to excite them to the n = 3 energy level. As the atoms return to the ground state, how many different energy-level transitions are possible?
    (1) 1 (3) 3
    (2) 2 (4) 4

12. Compared to the amount of energy required to excite an atom, the amount of energy released by the atom when it returns to the ground state is
    (1) less (3) the same
    (2) greater

13. Which phenomenon provides evidence that the hydrogen atom has discrete energy levels?
    (1) emission spectra (3) alpha particle scattering
    (2) photoelectric effect (4) natural radioactive decay

14. An excited atom emits a photon of energy E when an electron changes from energy level n = 3 to n = 2. In order for the same electron to change directly from energy level n = 2 to n = 3, it may
    (1) absorb a photon with energy E
    (2) absorb a photon with energy 2E
    (3) emit a photon with energy 3E
    (4) emit a photon with energy E/2

Wave-Particle Duality

1. The photon model of light is more appropriate than the wave model explaining
   (1) interference (3) polarization
   (2) refraction (4) photoelectric emission

2. Light demonstrates the characteristics of
   (1) particles, only (3) both particles and waves
   (2) waves, only (4) neither particles nor waves

3. Interference and diffraction can be explained by
   (1) the wave theory, only
   (2) the particle theory, only
   (3) neither the wave nor particle theory

4. Which phenomenon can be explained by both the particle model and wave model?
   (1) reflection (3) diffraction
   (2) polarization (4) interference

5. Which phenomenon can best be explained by the wave model of light rather than the particle model of light?
   (1) interference (3) energy transfer
   (2) reflection (4) refraction